

# Evaluation of bone geometry, quality and bone markers in children with type 1 diabetes

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## Introduction

Several studies have examined the relationship between type 1 diabetes and bone, however, with contradictory data on BMD, bone remodelling markers and bone quality. Nevertheless an increased prevalence of osteopenia was observed among patients with duration of disease of > 6 years.

## Objectives

The aim of the study was to investigate the potential negative impact of type 1 diabetes on bone status in a group of children with type 1 diabetes, by evaluating bone geometry, quality and bone markers

## Patients and Methods

82 children (47 m, 35 f), mean age  $10.7 \pm 3.0$  years, height SDS  $0.05 \pm 0.94$ , BMI SDS  $-0.49 \pm 0.87$  with a mean duration of type 1 diabetes of  $4.4 \pm 2.9$  years were studied. Bone geometry was evaluated on digitalized X-rays at the level of the 2nd metacarpal bone. The following parameters were investigated: outer diameter (D), inner diameter (d), cortical area (CA) and medullary area (MA), meanwhile bone quality was evaluated by ultrasound and expressed as amplitude dependent speed of sound (Ad-Sos) and bone transmission time (BTT). Data were converted to SDS and evaluated according to bone age. Bone markers (P1NP, CTX and BAP), sclerostin, Dkk-1, PTH and 25OHD were also assessed. Differences in bone geometry and quality were evaluated against zero, while the biochemical values of the patients were compared with a control group of 40 subjects of normal weight and height, which did not suffer of any chronic diseases.

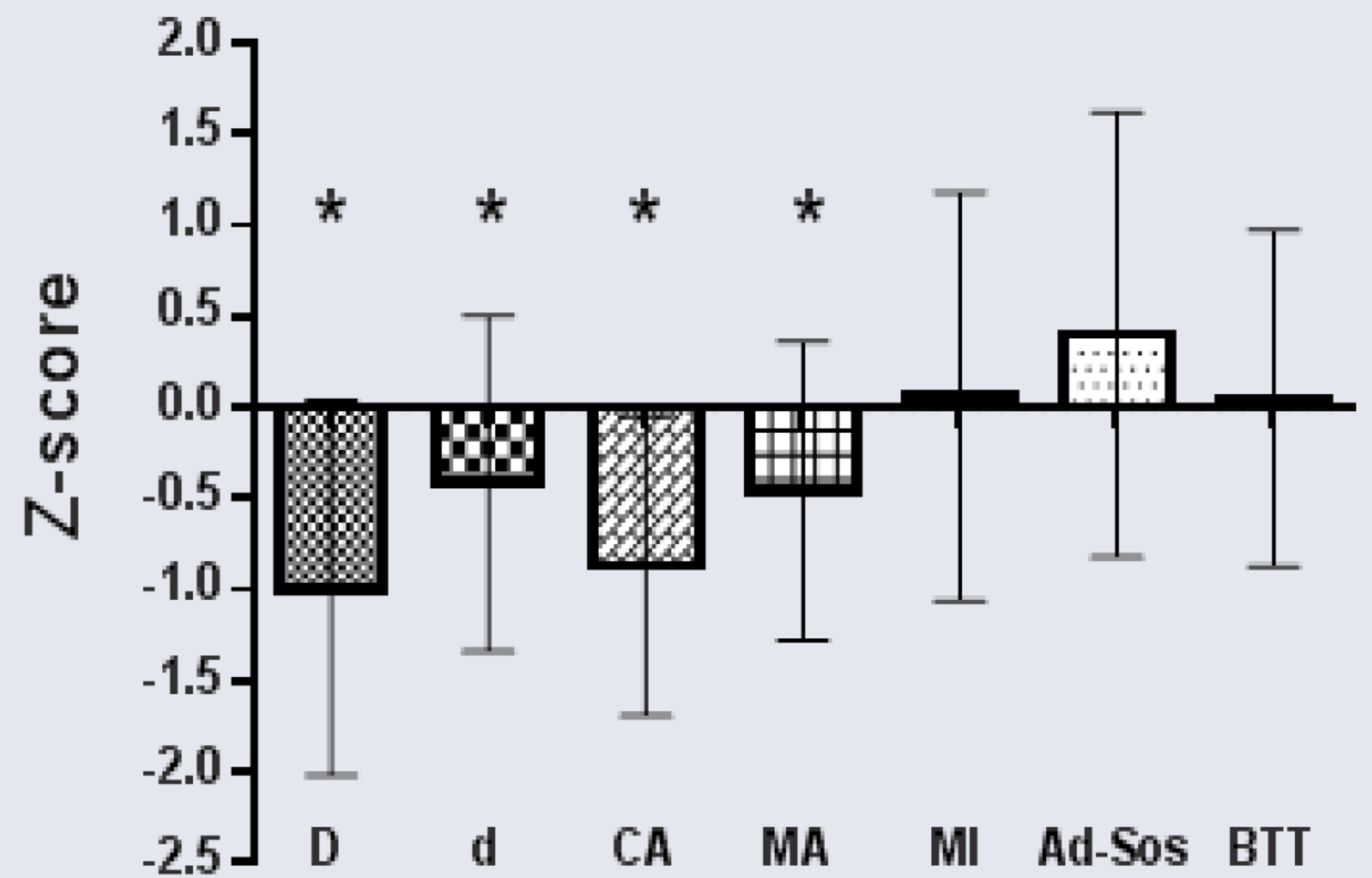


Figure 1. Bone geometry and bone quality. Outer diameter (D), inner diameter (d), metacarpal index (MI), cortical area (CA), medullary endocortical area (MA). Amplitude dependent speed of sound (Ad-Sos) and bone transmission time (BTT); \*= p<0,01

	25OH VIT D ng/ml	PTH pg/ml	P1NP ng/ml	BAP µg/L	CTX ng/ml	Dkk1 pmol/L	Sclerostin pmol/L
HbA1c <7.5%	23.7 ± 13.7	28.8 ± 10.1	560 ± 294	84.9 ± 39.8	1.3 ± 0.7	33.6 ± 16.9	31.1 ± 12.5
HbA1c >7.5%	22.3 ± 14.6	31.3 ± 16.8	695 ± 310	106.4 ± 35.1	1.4 ± 0.6	32.5 ± 14.8	33.1 ± 12.4
p	NS	NS	NS	<0.01	NS	NS	NS

Table 1. Biochemical markers in diabetic children with HbA1c < 7.5% and > 7.5%. Data are expressed as mean ± SD

## Results

D ( $-0.99 \pm 1.03$ ), d ( $-0.42 \pm 0.92$ ), CA ( $-0.87 \pm 0.82$ ) and MA ( $-0.46 \pm 0.82$ ) were all significantly smaller than in controls ( $P < 0.01$ ) while MI ( $0.06 \pm 1.12$ ), Ad-Sos ( $0.40 \pm 1.22$ ) and BTT ( $0.05 \pm 0.92$ ) were not significantly reduced. The bone markers were similar in children with type 1 diabetes and controls. When the patients were subdivided according to the HbA1c value <7.5% (n=35) and > 7.5% (n=47) no differences were found except for a BAP ( $106.43 \pm 35.12 \mu\text{g/L}$  vs  $84.99 \pm 39.84 \mu\text{g/L}$ ;  $p < 0.01$ ) which is a marker of bone formation

## Conclusions

Type 1 diabetic children show a bone of reduced size but with conserved proportion and quality. Bone turnover seems to be increased in patients with a suboptimal metabolic control.

